



Ethnobotanical insights into the traditional use of six medicinal plants in Morocco: Therapeutic applications, indigenous knowledge, and scientific valorization

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Research

Abstract

Background: This ethnopharmacological study documents traditional knowledge on the use of six medicinal plants (*Lavandula angustifolia*, *Mentha pulegium*, *Salvia sclarea*, *Pinus halepensis*, *Pistacia lentiscus*, and *Origanum compactum*) by the population of the Casablanca-Settat region for the treatment of infectious diseases.

Methods: Between January and July 2025, data were collected from 385 herbalists and traditional practitioners in both urban and rural areas using a structured questionnaire. Ethnobotanical indices, including Relative Frequency of Citation (RFC) and Fidelity Level (FL), were applied to evaluate the cultural and therapeutic relevance of each species.

Results: The majority of respondents (95.7%) regarded medicinal plants as a frequently used complementary or alternative option, with 97.1% reporting their regular use in practice. Decoction was the most common preparation method. Plant parts varied by species: leaves for *S. sclarea*, *M. pulegium*, *P. lentiscus*, and *O. compactum*; flowers for *L. angustifolia*; and bark for *P. halepensis*. *M. pulegium* had the highest RFC (0.852), followed by *L. angustifolia* and *O. compactum* (0.675 each). *M. pulegium* and *O. compactum* were predominantly used for respiratory infections, *P. lentiscus* for wound healing, and *L. angustifolia* and *O. compactum* for skin infections. Polyherbal remedies were the dominant practice, while *P. halepensis* was more frequently employed as a monotherapy. Oral administration was preferred, although dosing practices remained empirical and non-standardized.

Conclusions: These findings provide a foundation for pharmacological validation and the sustainable valorization of Moroccan medicinal plants as potential allies in the fight against antimicrobial resistance.

Keywords: Ethnobotany; traditional medicine; medicinal plants; Casablanca-Settat; infectious diseases.

Background

In the context of rising antibiotic resistance (a pressing global public health concern) particularly due to the persistence of recurrent and often nosocomial infections caused by critical drug-resistant pathogens identified by the World Health Organization (WHO 2024), such as *Staphylococcus* spp, the search for alternative therapeutic strategies is becoming increasingly urgent. Among the most promising approaches, medicinal plants represent a rich reservoir of bioactive compounds, many of which remain scientifically underexplored (Karalija *et al.* 2025). In Morocco, a longstanding tradition of phytotherapy, transmitted orally across generations, has played a crucial role in the treatment of various ailments, including bacterial infections (Elhasnaoui *et al.* 2024). This ethnobotanical heritage offers valuable potential for the discovery of novel antimicrobial agents.

However, this empirical knowledge remains insufficiently documented and rarely incorporated into current strategies aimed at combating resistant pathogens such as *Staphylococcus aureus* and coagulase-negative staphylococci (CoNS), which are frequently implicated in skin, urinary tract, respiratory, and device-associated infections (Azimi *et al.* 2020).

The use of traditional Moroccan medicine is widespread and continues to expand despite advances in modern therapies. Many Moroccans integrate traditional and conventional medical practices (Bouyahya *et al.* 2021). Traditional folk medicine draws on local knowledge, medicinal plants, prayers, rituals, and practices often linked to Islam. Herbalists, locally known as “Aachab” and “Attar” (derived from the Arabic words for “herb” and “scent”), play a central role in this system as suppliers, preparers, and advisers of remedies based on plants, minerals, and occasionally animal products (Fakchich & Elachouri 2021).

In this context, the present ethnobotanical study seeks to answer a key question: To what extent can this knowledge guide the search for effective natural alternatives against infections caused by *Staphylococcus* spp.?

The main objective of this research is to document, analyze local knowledge concerning six plant species traditionally used in Morocco (*Lavandula angustifolia*, *Mentha pulegium*, *Salvia sclarea*, *Pinus halepensis*, *Pistacia lentiscus*, and *Origanum compactum*) with a particular attention on their empirical applications in treating conditions potentially associated with staphylococcal infections.

This study adopts an ethnobotanical approach to systematically identify plants with therapeutic potential and to connect this knowledge to pharmacological validation. Through a comprehensive survey of 385 herbalists from rural and urban areas, information preparation methods, plant parts used, routes of administration, dosages, and usage frequency were collected. Quantitative ethnobotanical indices were applied to evaluate the therapeutic importance of each species in managing common staphylococcal infections.

By linking ethnobotanical knowledge with pharmacological evaluation, this study establishes a translational framework that bridges traditional medicine and modern science. It provides evidence-based insights into the antibacterial potential of selected medicinal plants, offering complementary approaches to conventional therapies and supporting efforts to combat antimicrobial resistance. Furthermore, the study emphasizes the need to preserve traditional knowledge while promoting the sustainable use of medicinal plant resources.

Materials and Methods

Study area and population

The Casablanca-Settat region, Morocco's main economic and demographic hub, covers 1,615 km² (2.7% of the national territory) and hosts nearly 6 million inhabitants, representing 20.3% of the national population (RGPH 2014). Administratively, it includes the prefectures of Casablanca and Mohammedia and the provinces of Settat, Berrechid, Sidi Bennour, El Jadida, Mediouna, Nouaceur, and Benslimane, which together comprise 153 municipalities. The region has a Mediterranean climate, with annual rainfall ranging from 220 to 760 mm and an average temperature of 22°C (Boudaia *et al.* 2024).

Geographically, the region is characterized by a 235 km Atlantic coastline, interior plains and plateaus, and the semi-arid Sahel zone with alternating depressions and stabilized dunes (Fig. 1).

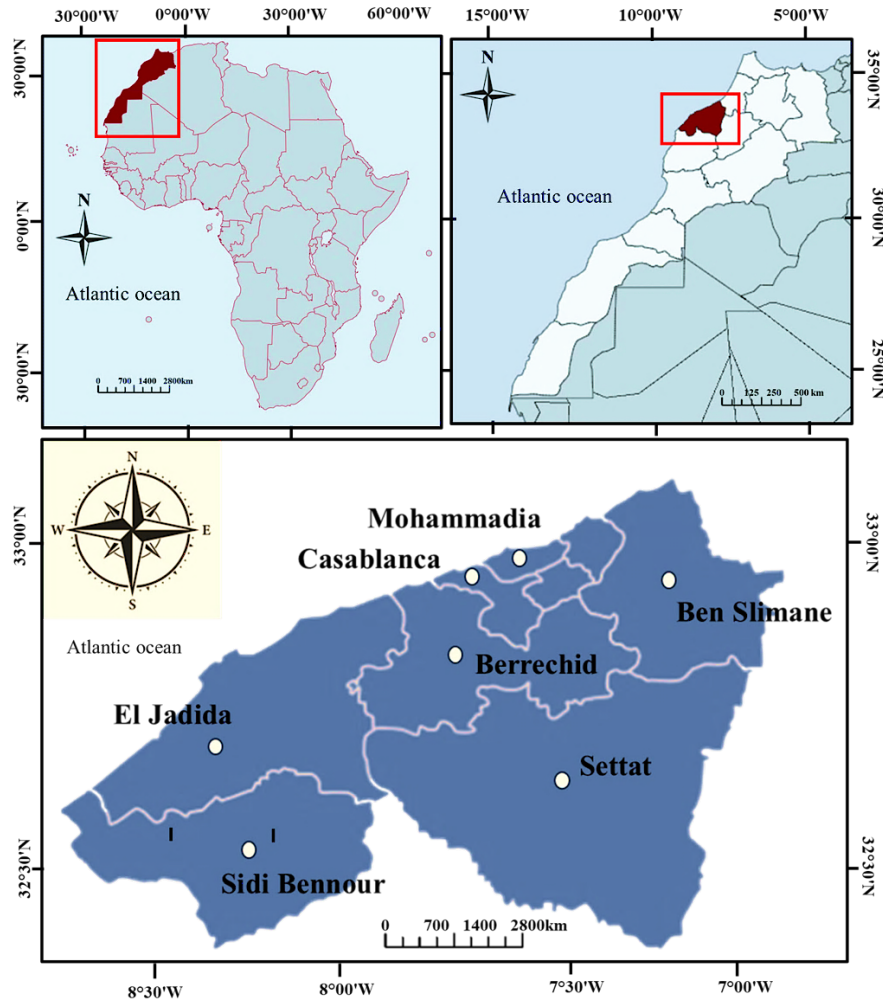


Figure 1. Geographical location of the study area: Casablanca-Settat Region, Morocco.

The Casablanca-Settat region is ecologically remarkable for its rich plant biodiversity, supported by approximately 114,107 hectares of forest, representing 6% of its total land area (RGPH 2014). Major woodlands include Oued Nfikh, located north of Casablanca and east of Mohammadia, and Bouskoura, the largest forest in the region, situated south of Casablanca. Additional forested areas, such as the Echallat forests along the western border of Oued El Maleh, further contribute to this ecological diversity.

Combined with the socio-cultural heterogeneity of its population, these characteristics make Casablanca-Settat an ideal setting for ethnobotanical investigations documenting and analyzing traditional medicinal plant use.

Ethnobotanical surveys

Study period

The survey was conducted over a seven-month period, from January to July 2025.

Study population

A total of 385 structured interviews were conducted, providing in-depth and reliable information on local medicinal practices. To ensure that the data reflected diverse geographic and socio-economic contexts, participants were recruited from both rural areas (villages, douars, and weekly markets or souks) and urban centers (towns and cities) within the Casablanca-Settat region. A purposive sampling approach was used to identify and include practicing herbalists actively involved in the prescription, preparation, or sale of medicinal plants.

Participants were eligible for inclusion if they were practicing herbalists actively involved in the prescription, preparation, or sale of medicinal plants. Individuals without direct professional experience in herbal medicine were excluded, in order to ensure that the data reflected specialized ethnobotanical knowledge rather than general public perceptions.

Sample size

The study population consisted of approximately 6.86 million inhabitants residing in the Casablanca-Settat region. The required sample size ($n = 385$) was calculated using Epi-Info® software, with a 95% confidence level and a 5% margin of error, without applying a finite population correction, as the population size is large enough for the standard formula to remain valid. The calculation was based on the formula:

$$n = Z^2 \times p \times (1-p) / D^2$$

where Z is the standard normal deviation at the selected confidence level (1.96 for 95%), D is the margin of error (0.05), and p is the estimated proportion of the population (0.05 for 5% precision).

Study design

The study employed a systematic ethnobotanical approach to document traditional knowledge concerning the use of medicinal plants. Data collection was carried out using a structured questionnaire, which was administered individually to herbalists, recognized as the main custodians of indigenous phytotherapeutic knowledge. Interviews were conducted in Arabic to ensure that participants could respond comfortably, without linguistic barriers or stress. Each interview lasted between 30 and 60 minutes, and informants were interviewed only once. All responses were recorded carefully to ensure accuracy and completeness.

A pilot study involving 40 herbalists was conducted to assess the face validity, reliability, and clarity of the questionnaire. Feedback from participants confirmed that the questions were comprehensible and required no further modification.

Reliability was evaluated using Cronbach's alpha (Taber 2018), both for individual dimensions and for the instrument as a whole, resulting in a coefficient of $\alpha = 0.7$, indicating an acceptable level of internal consistency.

The final 33-item instrument used for data collection is provided as Appendix S1 (Questionnaire), in the original Arabic and an English translation, with an item-to-section concordance (Sections 1–6). Face validity was established in a 40-herbalist pilot, and internal consistency for the full scale was acceptable (Cronbach's $\alpha = 0.70$). The first section included six socio-demographic variables (gender, age, place of residence, educational level, economic status, and geographical area). The second and third sections contained 17 and 2 questions, respectively, focusing on knowledge of medicinal plants, their identification, and pharmacological applications (vernacular names, plant parts used, treated diseases, preparation methods, and routes of administration). The fourth section included 5 questions addressing plant accessibility and conservation practices, while the fifth section contained 3 questions concerning knowledge transmission and satisfaction with plant use. The final section comprised 2 questions exploring participants' perceptions of medicinal plant use.

Plant identification was conducted specifically for the six selected medicinal species using standard floras available in online botanical databases, namely World Flora Online (<https://www.worldfloraonline.org/>) and the Medicinal Plant Names Services (<https://mpns.science.kew.org/>). The taxonomic nomenclature of each species was further validated by experts from the Department of Biology, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal.

This verification ensured accurate correspondence between local vernacular names and scientific taxonomy, thereby strengthening the reliability of the ethnobotanical data and providing a solid foundation for subsequent pharmacological studies."

Data processing and statistical analysis

The ethnopharmacological data collected through the survey underwent rigorous processing to enhance the analytical depth and reliability of the study. All responses were systematically organized, coded, and entered into structured data tables using Microsoft Excel 2016. Statistical analyses were subsequently performed using IBM SPSS Statistics (version 26; IBM Corp., Armonk, NY, USA).

To quantitatively assess the significance, frequency of use, and therapeutic relevance of the identified medicinal plant species, several well-established ethnobotanical indices were employed. These include:

Relative Frequency of Citation (RFC)

This index quantifies the prominence of each species within local medicinal practices, indicating how commonly a plant is cited by informants.

$$RFC = Fc / N \quad (0 < RFC < 1)$$

Fc: Number of informants who cited the use of a given plant; **N:** Total number of informants interviewed in the study.

Fidelity Level (FL)

FL measures the specificity of use of a plant species for treating a particular ailment, thus highlighting its perceived therapeutic reliability.

$$FL (\%) = Np / N \times 100$$

Np: Number of informants who mentioned the use of a plant for a specific disease; **N:** Total number of informants who mentioned the plant for any disease.

Factor Informant Consensus (FIC)

FIC evaluated the diversity of plant consumption patterns concerning the different studied pathologies.

$$FIC = (Nur - Nt) / (Nur - 1)$$

Nur: Number of citations of medicinal plants for each category of studied pathology; **Nt:** number of plants used to treat the same category of pathology

The application of these indices enabled a structured and quantifiable representation of traditional knowledge, thereby reinforcing the scientific credibility and valorization potential of the plant species investigated.

Results**Socio-demographic profile of herbalists interviewed**

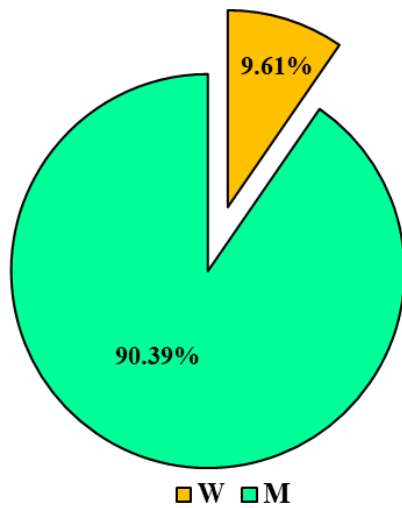
A total of 385 herbalists participated in the survey, comprising 37 women (9.61%) and 348 men (90.39%), yielding a male-to-female sex ratio of 9.4. The participants' ages ranged from 17 to 83 years, with a mean age of 41.65 ± 12.7 . Among male respondents, the most represented age groups were 25–34 years (24.1%; 84/348) and 45–54 years (19.8%; 69/348). For female respondents, the most common age groups were 25–34 and 55–64 years, each accounting for 24.32% (9/37) of the women surveyed. In terms of geographic distribution, 248 herbalists (64.42%) were from rural areas, while 137 (35.58%) were from urban settings (Fig. 2).

The survey findings reveal that a considerable proportion of herbalists have limited formal education: 38.7% were illiterate, 40.26% had attained only primary education, and 18.18% had attained the secondary level. In contrast, university-educated herbalists represented a small minority (2.86%).

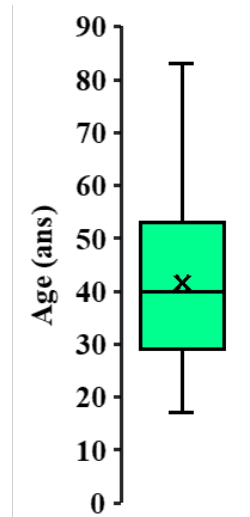
Regarding socio-economic status, the majority of respondents (66.8%) reported an average standard of living, whereas 25.7% were classified as having a low socio-economic level (Fig. 3).

Analysis of professional experience showed that 62.3% of herbalists had more than 10 years of practice, while 22.1% had been active for 5 and 10 years.

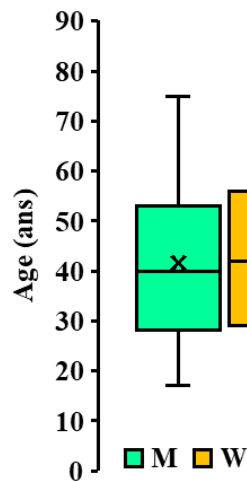
Regarding the sources of their knowledge, 47.5% indicated that they had acquired their expertise through practical experience in the field, particularly in local souks or markets. Additionally, 21.3% reported that their knowledge was inherited through intergenerational transmission within families traditionally engaged in herbal medicine, while 15.8% reported had received specific training from experienced herbalists (Fig. 4).



A: Distribution of study population by gender.



B: Age distribution of study population.



C: Distribution of study population by age and gender.

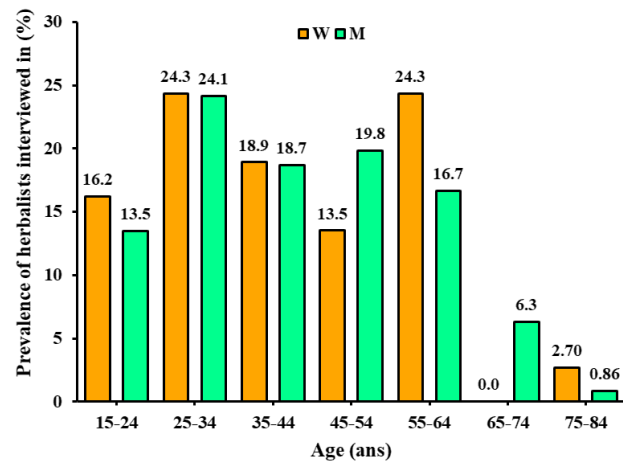
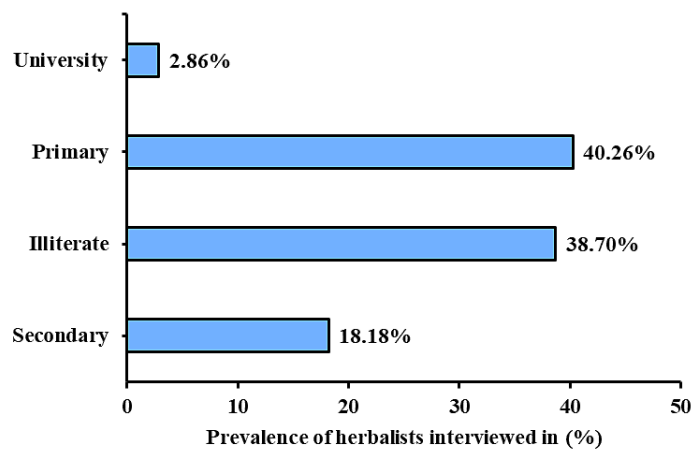
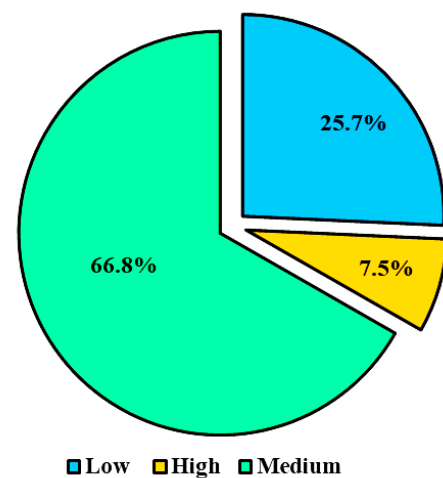


Figure 2. (A), (B), and (C) Descriptive analysis of the general study population. M : Male, W : Women.



(A) : Educational level



(B): Socio-economic status.

Figure 3. Distribution of surveyed herbalists according to (A) level of education and (B) socio-economic status.

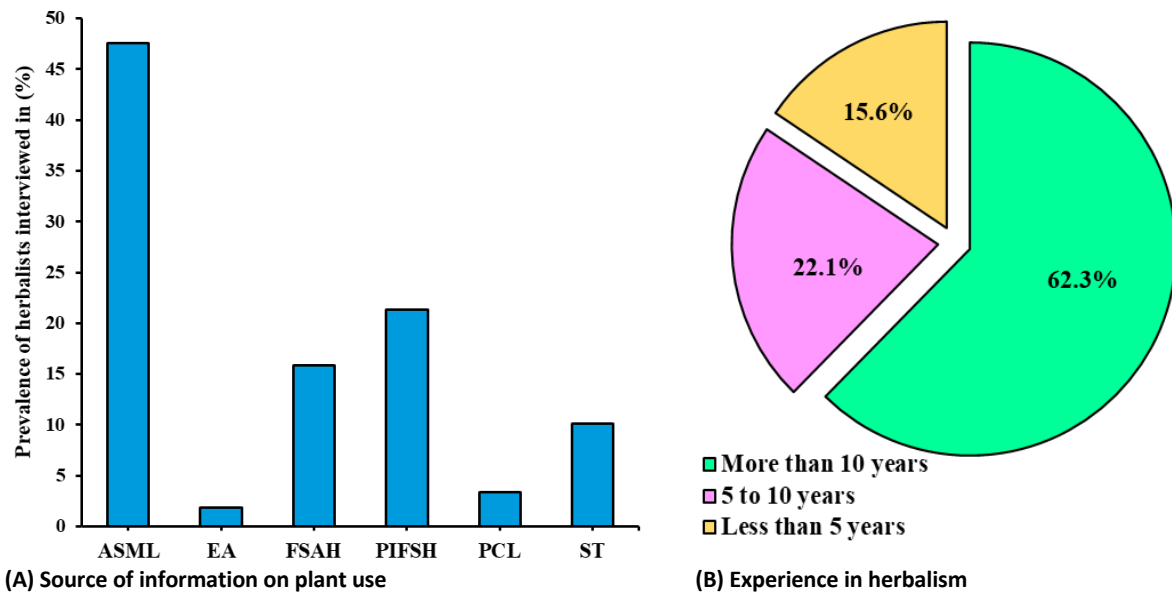


Figure 4. Distribution of surveyed herbalists according to (A) source of ethnobotanical knowledge and (B) years of experience in herbal medicine practice. ASML: Learning in local souks or markets; EA: Experiences of others; FSAH: Specific training with other herbalists; PIFSH: Intergenerational sharing in families specializing in herbal medicine; PCL: Local cultural practices; ST: Traditional knowledge.

Diversity of Medicinal Plants Used

Analysis of the responses reveals that the overwhelming majority of surveyed herbalists (98.2%) reported the use of medicinal plants in the treatment of various infections, whereas only 1.8% ($n = 7$) indicated otherwise.

From the six plant species selected, *M. pulegium* emerged as the most prominent, with a citation frequency of 85.2%. This was followed by *L. angustifolia* and *O. compactum*, each reported by 67.5% of respondents. *P. lentiscus* was also commonly mentioned (65.5%). Conversely, *P. halepensis* (39.2%) and *S. sclarea* (34.5%) were cited less frequently. The distribution of plant species usage among herbalists is illustrated in Figure 5.

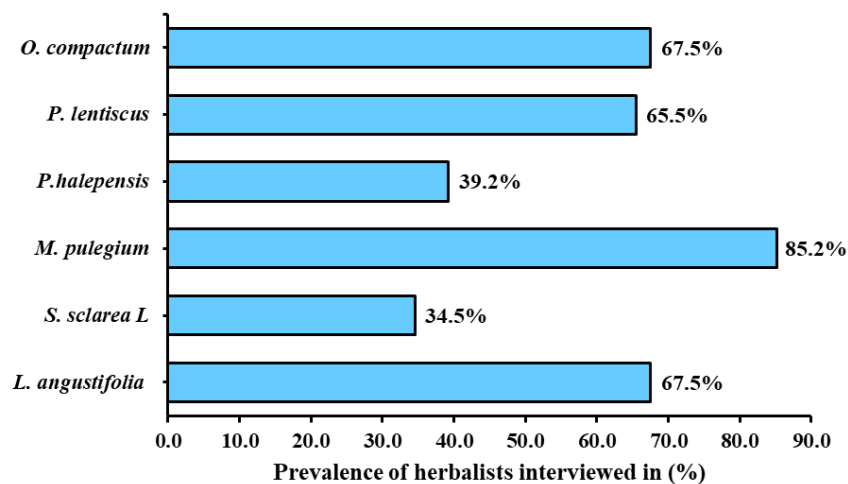


Figure 5. Distribution of medicinal plants selected by herbalists during the survey, expressed as percentages of total responses.

RFC analysis confirmed these trends, showing that all medicinal plants were cited by a substantial proportion of informants, with values ranging from 0.350 to 0.852. *M. pulegium* exhibited the highest RFC (0.852), indicating citation by over 85% of participants. *L. angustifolia* and *O. compactum* both recorded RFC values of 0.675, while *P. lentiscus* also showed a high RFC (0.655). In contrast, *S. sclarea* was less frequently cited (RFC = 0.350). *P. halepensis* presented a moderate value (0.392).

Clinical data: Infectious diseases targeted by medicinal plant use

Fidelity level (FL)

The analysis of the collected data allowed for the identification of the main infectious conditions for which medicinal plants are commonly employed by herbalists. Among the most frequently cited species, *M. pulegium* and *O. compactum* are particularly prominent in the treatment of respiratory infections, notably pneumonia, with citation rates of 87.5% and 91.2%, respectively.

P. lentiscus is primarily used for managing surgical or open wounds, with a usage frequency of 49.4%. In the context of genito-urinary infections, *L. angustifolia* is the most frequently mentioned species (38.96%), followed by *O. compactum* (19.74%) (Figure 6).

For skin infections such as boils and cellulitis, *L. angustifolia* (10.91%) and *O. compactum* (15.06%) are the most commonly cited. Notably, *O. compactum* is also frequently mentioned for infections related to medical devices (Catheters and prostheses), with a citation rate of 17.14%, underscoring its versatile role in traditional phytotherapy (Figure 6).

Finally, in the case of osteoarticular infections such as septic arthritis and osteomyelitis, *M. pulegium* (5.71%) and *O. compactum* (13.77%) were the most frequently cited species (Fig. 6).

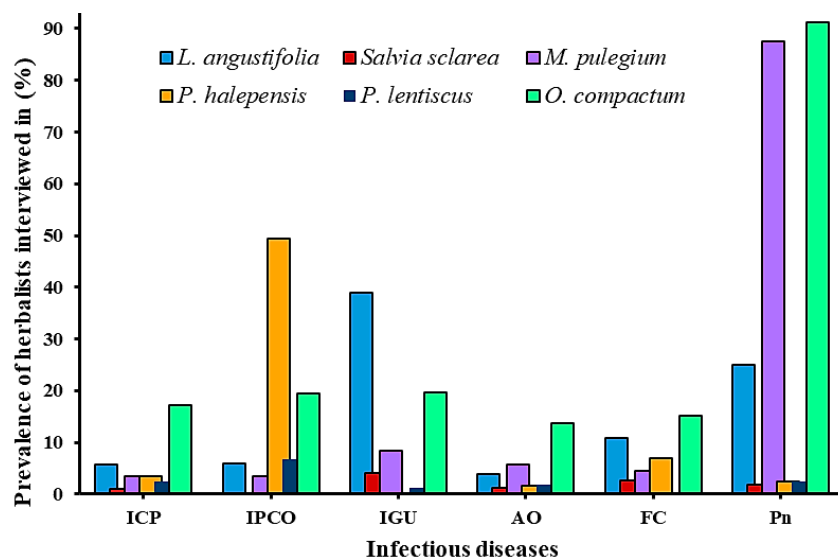


Figure 6. Therapeutic use of medicinal plants according to categories of infectious diseases, expressed as percentages of total respondents. Abbreviations: ICP: Infections related to catheters and prostheses; IPCO: Infections of surgical wounds or open wounds; IGU: Genito-urinary infections; AO – Arthritis or osteomyelitis; FC – Furuncles (boils) or cellulitis; Pn – Pneumonia.

Factor Informant Consensus (FIC)

The analysis of the FIC revealed consistently high values across all categories of infectious diseases examined, with scores ranging from 0.95 to 0.99. These results reflect a strong level of agreement among respondents regarding the medicinal plants traditionally used to treat specific infections.

The highest FIC values (0.99) were observed for infections related to surgical or open wounds, as well as for respiratory infections, particularly pneumonia. This high concordance indicates the presence of a well-established and widely shared body of ethnobotanical knowledge, likely associated with the perceived efficacy of certain plant species in managing these conditions. Similarly elevated FIC values (0.97) were recorded for skin infections, such as boils and cellulitis, and for osteoarticular infections, including arthritis and osteomyelitis. These findings further underscore the ethnopharmacological relevance of the cited plant species in the treatment of these ailments.

Genitourinary infections and infections associated with catheters or prosthetic devices showed slightly lower, yet still substantial, FIC scores of 0.95 and 0.96, respectively. These slightly lower scores may reflect a greater diversity of therapeutic approaches or variability in traditional treatment practices for these particular conditions.

Overall, the consistently high FIC values across all categories of infection highlight the coherence and reliability of local traditional knowledge regarding the medicinal use of plants, particularly their essential oils. These findings provide strong justification for further pharmacological and phytochemical research into the therapeutic potential of the most commonly cited species.

Diagnostic methods for infectious diseases

According to the herbalists interviewed, a substantial majority of their patients (87.1%) rely predominantly on self-diagnosis to identify and manage their health conditions, often without consulting a healthcare professional. In comparison, 9.4% of patients were reported to seek advice from a physician or pharmacist, while only 3.6% were said to turn directly to an herbalist for diagnostic guidance (Fig. 7).

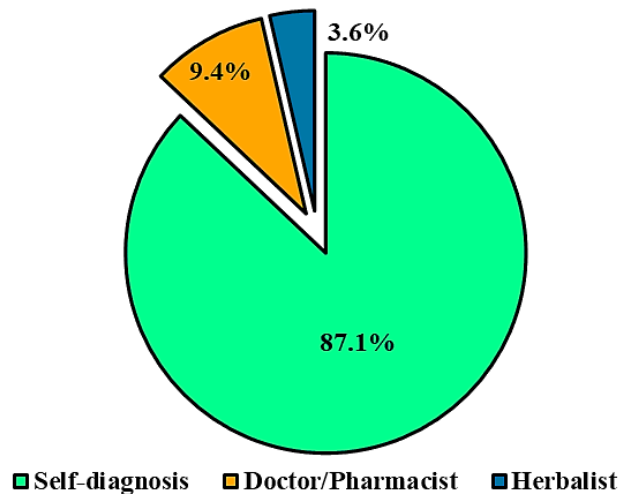


Figure 7. Distribution of diagnostic methods for infectious diseases, expressed as percentages of total respondents.

In the local cultural context, the recognition of infectious diseases is primarily based on observable symptoms such as fever, inflammation, swelling, pain, or the presence of wounds and suppuration. These manifestations are traditionally interpreted as signs of infection or “heat” in the body, reflecting an empirical diagnostic approach rooted in long-standing community health beliefs rather than biomedical criteria.

Data on use of the selected medicinal plants.

State of use

The results presented in Figure 8 highlight the predominant forms in which medicinal plants are utilized, as reported by herbalists. Across all species examined, the dried form overwhelmingly dominates. *M. pulegium* is employed in its dried state in 97.38% of cases, followed by *P. lentiscus* (93.07%) and *S. sclarea* (90.03%). In contrast, the use of fresh plant material remains limited, rarely exceeding 10%. This trend may be attributed to practical considerations such as storage constraints, seasonal availability, and a prevailing cultural perception that dried materials are more stable, durable, and easier to store.

The use of post-processed forms (such as essential oils, extracts, and other derivatives) is notably marginal, generally representing less than 1% of reported uses. This minimal adoption suggests a limited integration of advanced processing techniques in traditional practice, with herbalists favoring simpler, more accessible, and culturally entrenched methods of preparation.

Part used of the plants.

The selection of plant parts used in traditional medicine varies by species and, in some cases, is influenced by the specific therapeutic effect sought. Figures 9 illustrate the distribution of plant parts employed by the local population for the six studied species. For *S. sclarea*, *M. pulegium*, *P. lentiscus*, and *O. compactum*, the leaves are the most commonly utilized part, with reported usage rates of 87.2%, 98.2%, 86.9%, and 96.6%, respectively. In contrast, for *L. angustifolia*, the flowers are predominantly used, cited by 97.9% of respondents. As for *P. halepensis*, the bark is the principal plant part employed, accounting for 77.2% of reported uses.

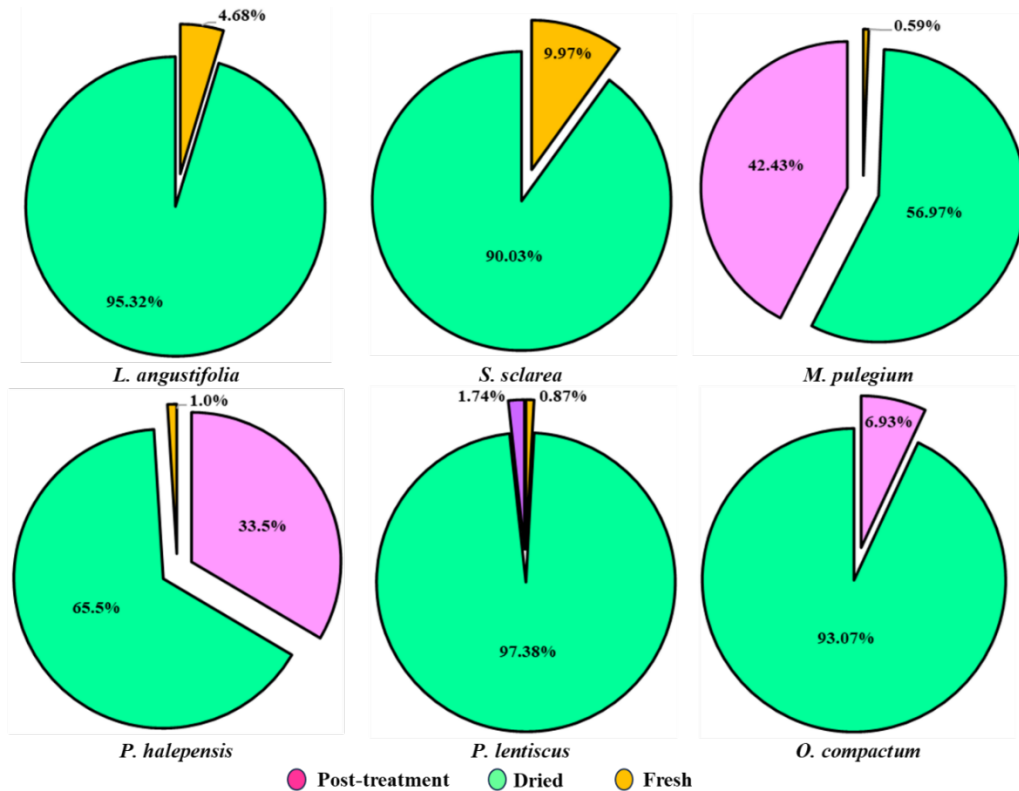


Figure 8. The state of use of the plants, expressed as percentages of total respondents.

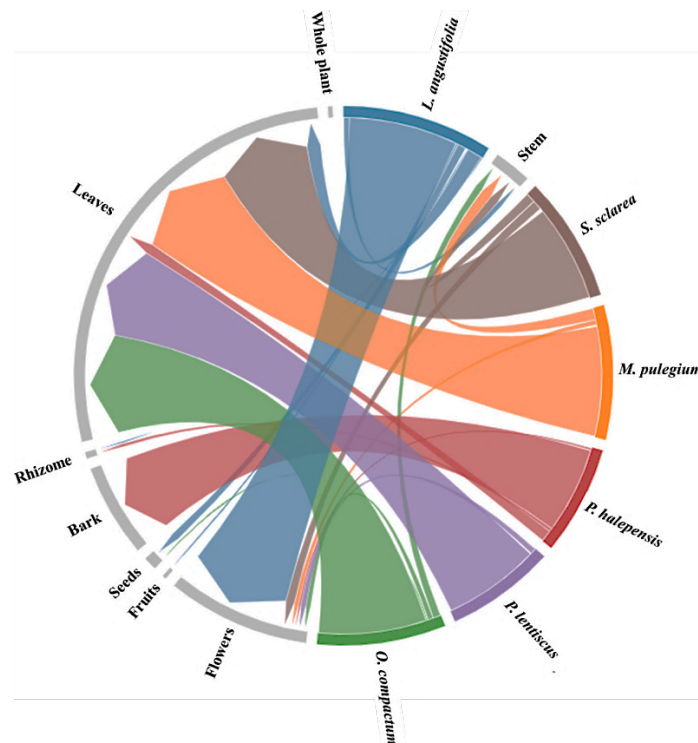


Figure 9. Distribution of plant parts used in traditional medicine, expressed as percentages of total respondents.

Preparation methods used of plants

The findings of this study indicate that the majority of medicinal plants recommended by herbalists are predominantly administered as decoctions or infusions, reflecting the central role of traditional aqueous preparations in local phytotherapeutic practices. Decoction emerged as the most frequently cited method, with usage rates of 75.35% for *P. lentiscus*, 65.06% for *L. angustifolia*, and 50.41% for *O. compactum*. In parallel, infusion was particularly common for *M.*

Collectively, these results highlight a strong cultural inclination toward accessible and traditional modes of preparation, deeply embedded within community-based health practices. They also emphasize the continued intergenerational transmission of ethnopharmacological knowledge, which remains a vital aspect of healthcare in the regions surveyed (Fig. 10).

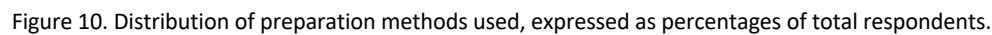


Table 1. Distribution of the frequency of use of specific decoction and infusion preparation techniques as reported by surveyed herbalists.

Method	Parameter	<i>L. angustifolia</i>	<i>S. sclarea</i>	<i>M. pulegium</i>	<i>P. halepensis</i>	<i>P. lentiscus</i>	<i>O. compactum</i>
Decoction	Duration (min)						
	< 5	31.7(n=57)	23.1 (n=37)	43.3 (n=58)	15.8 (n=6)	38.2 (n=79)	36.4 (n=67)
	5–10	43.3 (n=78)	41.9 (n=67)	39.6 (n=53)	36.8 (n=14)	37.2 (n=77)	41.8 (n=77)
	11–20	22.2 (n=40)	25.6 (n=41)	14.9 (n=20)	23.7 (n=9)	18.8 (n=39)	18.5(n=34)
	21–30	2.8 (n=5)	9.4 (n=15)	2.2 (n=3)	23.7 (n=9)	5.8 (n=12)	3.3 (n=6)
	Temperature (°C)						
	100	100 (n=179)	41 (n=67)	100 (n=138)	97 (n=38)	99 (n=205)	99 (n=183)
	50	0	59 (n=96)	0	3 (n=1)	1 (n=2)	1 (n=1)
	Solvent	Water (100%)	Water (100%)	Water (100%)	Water (100%)	Water (100%)	Water (100%)
	Duration (min)						

Infusion	< 5	17.6 (n=16)	15.3 (n=15)	24.5 (n=46)	0	33.3 (n=11)	21.1 (n=36)
	5–10	40.7 (n=37)	39.8 (n=39)	38.8 (n=73)	33.3 (n=1)	30.1 (n=22)	42.1 (n=72)
	11–20	28.6 (n=26)	23.5 (n=23)	21.8 (n=41)	33.3 (n=1)	41.1 (n=30)	21.1 (n=36)
	21–30	13.2 (n=12)	21.4 (n=21)	14.9 (n=28)	33.3 (n=1)	13.7 (n=10)	15.8 (n=27)
	Temperature (°C)						
	100	0	2 (n=2)	2 (n=2)	0	1.6 (n=1)	1.2 (n=2)
	50	100 (n=50)	98 (n=96)	98 (n=191)	100 (n=3)	100 (n=62)	100 (n=169)
	Solvent	Water (100%)	Water (100%)	Water (100%)	Water (100%)	Water (100%)	Water (100%)

Regarding decoction, the majority of herbalists favor short to moderate preparation times, predominantly between 5 and 10 minutes, with usage frequencies ranging from 36.8% for *P. halepensis* to 43.3% for *L. angustifolia*. A considerable proportion of preparations are also conducted in less than 5 minutes, particularly for *M. pulegium* (43.3%) and *P. lentiscus* (38.2%), the brevity of the preparation time likely contributes to the preservation of thermolabile bioactive compounds. Prolonged exposure to heat or excessive boiling can alter the chemical profile of plant extracts by degrading or volatilizing sensitive constituents such as essential oils, flavonoids, and phenolic compounds which may, in turn, compromise their therapeutic potential. Extended decoction times between 11 and 30 minutes are less frequently reported, though longer durations (21–30 minutes) are noted for *S. sclarea* (9.4%) and *P. halepensis* (23.7%).

In terms of temperature, decoctions are almost universally prepared using boiling water (100°C) across all species, in alignment with the objective of extracting thermolabile and water-soluble active constituents. Water is consistently used as the sole solvent, highlighting the simplicity and accessibility of this traditional method.

Infusion practices display greater variability, although the 5–10 minutes duration remains the most frequently reported, with rates ranging from 30.1% for *P. lentiscus* to 42.1% for *O. compactum*. Short infusions (<5 minutes) are particularly common for *M. pulegium* (24.5%) and *P. lentiscus* (33.3%), likely due to their aromatic nature, which facilitates the rapid diffusion of volatile compounds. Longer steeping durations (11–20 and 21–30 minutes) are also frequently observed for certain species, such as *S. sclarea* and *M. pulegium*.

Unlike decoctions, infusions are typically prepared at lower temperatures, with the majority of herbalists reporting the use of hot water at approximately 50°C, in accordance with the classical definition of infusion, which avoids boiling. Once again, water is exclusively used as the extraction medium, underscoring a consistent reliance on accessible, natural solvents in traditional herbal practices.

Usage mode

The collected data highlight a wide range of therapeutic practices involving medicinal plants, with notable variation depending on the species used. Overall, polyphytotherapy emerges as the dominant strategy. This approach is particularly prevalent for *M. pulegium* (80.70%), *S. sclarea* (75.88%), and *O. compactum* (73.78%), underscoring a common belief among traditional practitioners that the synergistic effects of combined species enhance therapeutic outcomes and expand the spectrum of biological activity.

In contrast, monophytotherapy remains a common, though generally less favored, practice across most species. A notable exception is *P. halepensis*, which is employed in monotherapy in 72.68% of reported cases. This preference may reflect the species' distinct pharmacological properties and its perceived effectiveness as a standalone treatment for specific ailments (Fig. 11).

The results obtained allowed us to identify the therapeutic doses employed by herbalists for treating various infections, as illustrated in Table 2.

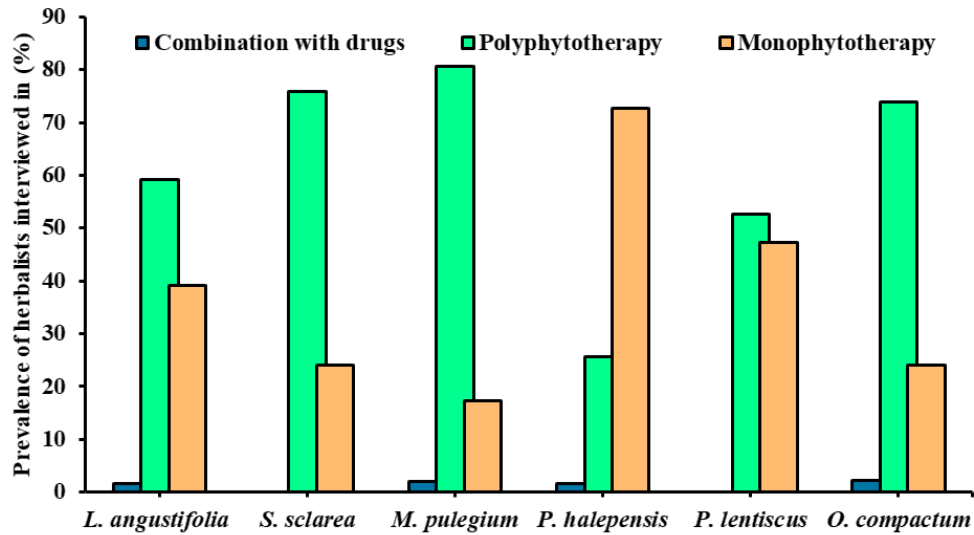


Figure 11. Distribution by plant use, expressed as percentages of total respondents.

Therapeutic doses used

Table 2. Therapeutic doses, methods of administration, and treatment duration frequencies for medicinal plants prescribed by herbalists.

Plant / Variable	<i>L. angustifolia</i>	<i>S. sclarea</i>	<i>M. pulegium</i>	<i>P. halepensis</i>	<i>P. lentiscus</i>	<i>O. compactum</i>
Therapeutic doses						
Spoonful	50.69% (n=146)	55.68% (n=98)	63.99% (n=215)	40.11% (n=73)	55.96% (n=155)	63.19% (n=230)
Pinch	3.13% (n=9)	0.57% (n=1)	0.60% (n=2)	6.59% (n=12)	0.36% (n=1)	1.37% (n=5)
Handful	17.71% (n=51)	10.80% (n=19)	10.12% (n=34)	14.84% (n=27)	15.88% (n=44)	9.07% (n=33)
Precise quantity	28.47% (n=82)	32.95% (n=58)	25.30% (n=85)	38.46% (n=70)	27.80% (n=77)	26.37% (n=96)
Routes of administration						
Brush	4.76% (n=10)	5.83% (n=12)	1.69% (n=6)	33.90% (n=20)	2.34% (n=7)	5.41% (n=19)
Massage	6.19% (n=13)	2.91% (n=6)	1.97% (n=7)	5.08% (n=3)	1.00% (n=3)	5.70% (n=20)
Oral	89.05% (n=187)	77.67% (n=160)	93.52% (n=332)	42.37% (n=25)	94.98% (n=284)	84.90% (n=298)
Rinse	0.00% (n=0)	13.59% (n=28)	2.82% (n=10)	18.64% (n=11)	1.67% (n=5)	3.99% (n=14)
Treatment duration						
Until recovery	80.82% (n=236)	83.15% (n=148)	80.47% (n=276)	84.88% (n=146)	85.04% (n=233)	83.24% (n=303)
One day	10.62% (n=31)	2.25% (n=4)	1.75% (n=6)	4.07% (n=7)	6.20% (n=17)	5.49% (n=20)
One month	1.03% (n=3)	1.12% (n=2)	2.92% (n=10)	0.00% (n=0)	0.36% (n=1)	0.27% (n=1)
One week	7.53% (n=22)	13.48% (n=24)	14.87% (n=51)	11.05% (n=19)	8.39% (n=23)	10.99% (n=40)

The majority of respondents reported that medicinal plants are administered using approximate, non-standardized doses. Among the traditional units of measure cited, the spoon emerged as the most commonly used, particularly for *M. pulegium*.

(63.99%), *O. compactum* (63.19%), and *S. sclarea* (55.68%). The “handful” was also employed, though to a lesser extent, with usage rates ranging from 9.07% for *O. compactum* to 17.71% for *L. angustifolia*. The “pinch” was reported only marginally, not exceeding 6.59% for *P. halepensis* and remaining below 0.5% for most other species.

A considerable proportion of herbalists reported using approximate, experience-based quantities such as “a spoonful” or “a handful”, although some indicated more precisely defined amounts, particularly for *P. halepensis* (38.46%) and *S. sclarea* (32.95%).

Routes of administration

The findings of this study reveal that the oral administration is the predominant mode of administration for the medicinal plants studied. It is overwhelmingly preferred by traditional herbalists, particularly for *P. lentiscus* (94.98%), *M. pulegium* (93.52%), and *L. angustifolia* (89.05%) (Table 2).

Consumption frequency

The data reveal substantial variability in the frequency of medicinal plant administration among the species studied. Overall, once-daily dosing was the most frequently reported regimen, particularly for *L. angustifolia* (60.87%) and *P. halepensis* (59.49%). This preference may be attributed to the nature of the preparations (Infusions and decoctions) and the perception that a single daily intake is sufficient to achieve the desired therapeutic effect.

In contrast, more frequent administration (Three or more times per day) was more commonly associated with certain species, notably *M. pulegium* (44.88%) and *O. compactum* (41.10%). This pattern may reflect the need for more intensive therapeutic regimens or the necessity of dose renewal to maintain efficacy throughout the day. *S. sclarea* showed a relatively balanced distribution between once-daily (47.50%) and three-times-daily (32.50%) administration, suggesting a degree of flexibility based on individual patient needs.

Twice-daily administration was consistently reported across all species, ranging from 18.90% for *M. pulegium* to 25.80% for *P. lentiscus*. This intermediate frequency may be employed in cases of moderate symptomatology or for preventive purposes.

These findings illustrate the nuanced empirical nature of traditional dosing practices, shaped by factors such as the pharmacological characteristics of each plant, the type and severity of the condition being treated, and culturally embedded conceptions of appropriate dosage (Fig. 12).

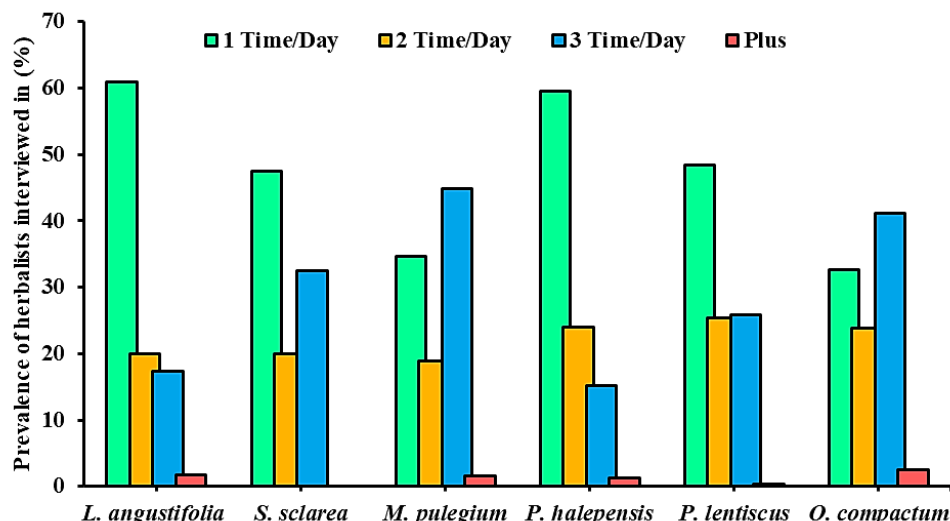


Figure 12. Distribution of consumption modes, expressed as percentages of total respondents.

Duration of use

The results indicate that, for the majority of the medicinal plants examined, treatment duration is primarily guided by the resolution of symptoms rather than adherence to a fixed timeframe (Table 2). This symptom-based approach was predominant, with reported frequencies ranging from 80.47% for *M. pulegium* to 85.04% for *P. lentiscus*. Such practice reflects the flexible, individualized nature of traditional medicine, wherein treatment is continued as long as clinical signs

persist. This mode of administration aligns with the foundational principles of ethnomedicine, which emphasize close observation of the patient's condition over standardized therapeutic durations.

In contrast, the use of predefined treatment periods (such as one day, one week, or one month) was relatively infrequent. This may be explained by the common use of these plants for mild or self-limiting conditions, or as initial interventions whose duration is later adjusted based on the patient's response. The variability observed in treatment length underscores a system rooted in oral tradition, where adaptability and personalization are prioritized over rigid or uniform therapeutic protocols.

Satisfaction rates and side effects

The survey results indicate that the use of *L. angustifolia*, *S. sclarea*, *M. pulegium*, *P. halepensis*, *P. lentiscus*, and *O. compactum* is generally well tolerated, with few reported adverse effects; several species were even described as completely free of side effects. Moreover, the overall satisfaction rate among users exceeded 96% for all six plants, reflecting a high level of confidence in their perceived therapeutic efficacy. These findings underscore the deep-rooted integration of these remedies into traditional medical practices and their enduring importance within local communities.

Access to medicinal plants

The cultivated plants or those obtained through wild harvesting remain marginal sources, indicating a low level of investment in domestic cultivation or the preservation of traditional knowledge related to wild collection. This trend suggests an increasing reliance on market channels, gradually supplanting traditional practices of self-sufficiency.

The data collected indicate generally satisfactory accessibility to the medicinal plants studied, with availability rates exceeding 87% for all species. *O. compactum* (93.11%) and *P. lentiscus* (92.74%) were perceived as the most accessible by the herbalists surveyed. This accessibility is primarily attributed to the availability of these plants in commercial form, which accounts for over 90% of cases, reflecting their strong integration within both formal and informal distribution networks.

The conservation of medicinal plants appears largely neglected, with most respondents reporting no specific conservation efforts. This lack of proactive measures raises concerns, particularly in light of escalating environmental pressures. Notably, a vast majority of herbalists express awareness of the adverse impacts of climate change on plant resource availability, with particularly high recognition for *L. angustifolia* (97.94%) and *O. compactum* (97.99%). Although this environmental awareness is promising, it has yet to translate into tangible conservation initiatives, highlighting a gap between risk perception and the implementation of sustainable practices (Table 3).

Table 3. Herbalists' perceptions of accessibility, forms of availability, conservation efforts, and the impact of climate change on the main medicinal plants used.

Medicinal Plant	<i>L. angustifolia</i>	<i>S. sclarea</i>	<i>M. pulegium</i>	<i>P. halepensis</i>	<i>P. lentiscus</i>	<i>O. compactum</i>
Access to the plant						
Accessible	87.46	89.21	91.70	89.29	92.74	93.11
Not accessible	12.54	10.79	8.30	10.71	7.26	6.89
Form of availability						
Commercial	95.09	95.61	93.57	99.25	98.72	92.12
Cultivated	2.02	2.19	4.68	0	0	5.71
Wild	2.89	2.19	1.75	0.75	1.28	2.17
Conservation efforts						
No	88.48	88.78	89.60	90.50	92.31	84.81
Yes	11.52	11.22	10.40	9.50	7.69	15.19
Perceived Climate Impact						
Yes	97.94	93.95	93.22	75.80	79.15	97.99
No	2.06	6.05	6.78	24.20	20.85	2.01

Perception of use and methods of transmitting knowledge among herbalists

The findings of this study reveal that a substantial majority of herbalists (95.7%) consider medicinal plants to be a legitimate alternative to conventional medical treatments. Most respondents (75.9%) cited the perceived therapeutic efficacy of these plants as the primary reason of their use. In addition, 14.1% expressed dissatisfaction with the effectiveness of modern pharmaceuticals, while 10% emphasized the lower cost of traditional remedies as a motivating factor. Notably, 97.1% of herbalists reported incorporating medicinal plants into their daily practice, underscoring the enduring relevance of traditional medicine even in contexts where modern healthcare systems are accessible.

Perceived threats to the continued use of medicinal plants are mainly linked to the modernization of healthcare systems, cited by 66.95% of respondents. This is followed by concerns regarding the erosion of intergenerational transmission of traditional knowledge (21.84%), the loss of biodiversity (8.91%), and, to a lesser extent, the effects of climate change (2.30%).

Discussion

Ethnobotanical comparison

Our research constitutes an ethnobotanical study involving 385 herbalists, providing valuable insights into the traditional use of select medicinal plants within the study region.

A pronounced male predominance was observed among participants (90.39%), reflecting the demographic composition of practicing herbalists in the Casablanca-Settat region, where men predominantly manage herbalist shops and commercial phytotherapy activities. This imbalance is therefore partly a consequence of the sampling approach, which focused on professional practitioners. Nevertheless, it is important to note that numerous ethnobotanical studies across Morocco and North Africa have documented the central role of women in preserving and transmitting medicinal plant knowledge within domestic and community settings (Boudjelal *et al.*, 2013). Thus, the present findings likely reflect occupational representation rather than the actual gendered distribution of ethnobotanical knowledge.

The socio-economic and educational profile of the herbalists surveyed reveals that 38.7% are illiterate, with the majority (66.8%) belonging to the middle socio-economic class. Traditional phytotherapeutic knowledge in Morocco is primarily transmitted orally through apprenticeship and observation rather than formal education.

Consequently, illiteracy does not necessarily hinder the possession or transmission of this empirical knowledge, which remains deeply rooted in practice and community experience. However, limited formal education may affect the precision of dosage estimation or the written documentation of recipes, posing challenges for standardization and safety.

These findings highlight that traditional knowledge represents a dynamic cultural system, preserved through oral tradition and practice, but which can be further strengthened through scientific collaboration, literacy initiatives, and documentation efforts aimed at ensuring its continuity and reliability. Indeed, the study identified a lack of standardization in dosing practices, with units such as “pinch,” “handful,” or “spoonful” subject to individual interpretation, potentially leading to variability in the efficacy and safety of administered remedies (Rinto *et al.* 2023).

Regarding the plant species identified, six medicinal plants were selected: *L. angustifolia*, *M. pulegium*, *S. sclarea*, *P. halepensis*, *P. lentiscus*, and *O. compactum*, belonging to the Lamiaceae, Pinaceae, and Anacardiaceae families. These species are frequently cited in Moroccan and Mediterranean pharmacopoeias for their antimicrobial, anti-inflammatory, and wound-healing properties.

The analysis of the Relative Frequency of Citation (RFC) identified *M. pulegium* as the most frequently mentioned species, reflecting its prominent role in traditional medicine for treating infectious diseases. *L. angustifolia* and *O. compactum* were also widely cited, confirming their deep integration into the Moroccan pharmacopoeia and their long-standing recognition for antiseptic, anti-inflammatory, and antibacterial properties. *P. lentiscus* likewise emerged as an important medicinal plant, traditionally employed in the management of skin and urinary tract infections. Meanwhile, *S. sclarea* and *P. halepensis* were less frequently reported, yet remain valued within local healing practices, particularly for their applications in wound healing and dermatological care. Overall, the prominence of these six species in the present study is consistent with numerous ethnobotanical reports across Morocco and North Africa, underscoring their enduring role in regional phytotherapeutic traditions (Benamar *et al.* 2023) (Merouane *et al.* 2025).

It is well established that different plant parts vary in their concentration and composition of bioactive compounds, sometimes displaying entirely distinct phytochemical profiles (Altemimi *et al.* 2017). According to our findings, leaves and flowers are the plant parts most frequently used by herbalists, reflecting a rich body of empirical knowledge transmitted across generations. However, practitioners may not always be fully aware of the specific phytochemical composition characteristic to each plant organ. Their selection is predominantly guided by traditional heritage rather than detailed scientific understanding, which may limit the optimal therapeutic use of the species employed.

The therapeutic efficacy of medicinal plants within the studied region is intrinsically linked to their chemical composition, particularly the active compounds they contain. Our survey results indicate that decoctions and infusions are the most commonly employed preparation methods, corroborating findings reported by Achour *et al.* (Achour *et al.* 2022), who also identified decoction, infusion, and plant powder as principal preparation techniques. These galenic preparations are generally administered orally for internal ailments or applied topically for skin and hair care. Such traditional practices are consistent with those documented in ethnobotanical surveys from neighboring regions, underscoring a deeply rooted cultural tradition and sustained intergenerational transmission of phytotherapeutic knowledge (Achour *et al.* 2022; Zeggwagh *et al.* 2013).

Risks, toxicity, and need for standardization

In Morocco, plant-derived intoxications represent 5.1% of all recorded poisoning cases, excluding those caused by scorpion stings and other envenomations. Among the most frequently implicated species, glue thistle (*Atractylis gummifera*) accounts for 10.1% of cases, followed by *Cannabis sativa* (4.6%) and *Peganum harmala* (3.6%) (Zeggwagh *et al.* 2013).

The absence of reported side effects for the six medicinal plants studied reflects the confidence placed by traditional practitioners and users in their empirical safety and efficacy. This finding underscores the resilience and reliability of traditional phytotherapeutic knowledge, which has been refined over generations through careful observation and experience. However, transforming this heritage into scientifically validated therapeutic resources requires the integration of modern pharmacological evaluation. Experimental studies are thus essential to confirm antimicrobial efficacy, identify active compounds, and establish standardized and safe dosage guidelines (Caputo *et al.* 2021).

In this perspective, the present study provides a foundation for bridging traditional ethnobotanical knowledge and modern biomedical research. By valorizing local practices while applying rigorous pharmacological validation, it becomes possible to enhance both the credibility and safety of traditional medicine, contributing to the search for effective, evidence-based natural alternatives for managing infectious diseases (Zeggwagh *et al.* 2013).

Pharmacological perspectives

Medicinal plants are widely used by local populations for their therapeutic effects, which are attributed to the active compounds they contain. Although these bioactive constituents can provide substantial health benefits, they may also exhibit toxic effects beyond certain thresholds. Our findings highlight a prevailing reliance on empirical dosage practices such as the use of spoonfuls, pinches, or handfuls without reference to standardized measurements. Treatments are often continued until the subsides, in the absence of defined duration or precise dosing regimens.

This traditional approach, though deeply rooted in cultural practice, poses challenges for ensuring safety, reproducibility, and therapeutic consistency. To bridge this gap, gradual integration of internationally recognized frameworks such as the WHO guidelines for the safe use of herbal medicines could facilitate the standardization of dosages and preparation methods (WHO 2024). Such an approach would preserve the cultural authenticity of traditional practices while promoting evidence-based validation, thereby enhancing both safety and therapeutic reliability. Similar observations have been reported in other ethnobotanical studies conducted in Morocco and across North Africa (Busia 2024).

Herbalists are often regarded as custodians of valuable empirical knowledge, particularly regarding the appropriate dosages for treating various ailments (de Souza Silva *et al.* 2014). However, it is important to note that the concentration of active compounds in medicinal plants can vary considerably due to environmental and physiological factors. These include soil composition and geological substrate, climatic conditions, harvesting time, plant age, and the specific organ used. Such variability directly influences the therapeutic efficacy and safety of herbal preparations, underscoring the need for standardized practices and stronger scientific validation. (Balkrishna *et al.* 2024). Indeed, certain plant species are traditionally believed to exert their greatest therapeutic effects during specific periods of the year. In some communities, their use is even discouraged or prohibited outside these seasonal windows, due to perceived changes in their efficacy or

potential toxicity. This body of folk knowledge reflects a long-standing, nuanced understanding of natural cycles, yet it requires thorough documentation and comparison with pharmacological data to assess its scientific basis.

Another noteworthy aspect is the widespread use of polyphytotherapy, favored by most herbalists. This traditional approach, based on the combining several plant species, is believed to enhance therapeutic efficacy through synergetic interaction. However, the pharmacodynamic and pharmacokinetic interactions among the bioactive compounds in these mixtures remain largely unexplored, raising concerns about the possible adverse or antagonistic effects (Hemaiswarya *et al.* 2022). Conversely, certain plants such as *P. halepensis* are used in monophytotherapy, possibly reflecting empirical recognition of their intrinsic efficacy (El Omari *et al.* 2021). Such species represent promising targets for detailed pharmacological research.

Conservation and durability

From an accessibility standpoint, most herbalists surveyed consider medicinal plants to be readily available, a perception largely attributed to their widespread commercialization in local markets. However, this apparent abundance masks a more concerning reality: the near-total absence of concrete initiatives aimed at conserving, domesticating, or sustainably cultivating the species in use. Although practitioners increasingly acknowledged the adverse effects of climate change on plant availability, this environmental awareness has yet to be translated into effective local action for protecting the most vulnerable species.

The sustainability of medicinal plants is, in fact, threatened by multiple pressures, including overharvesting, unsustainable collection practices, restricted geographic distribution, habitat specificity, and the degradation of ecosystems caused by human activity and climate change. Collectively, these cumulative factors pose a serious risk to the biodiversity of medicinal plants, their long-term therapeutic potential, and the ecological integrity of their natural habitats (Chen *et al.* 2016).

In summary, this study highlights the richness of local ethnobotanical knowledge and its vital role in primary healthcare. It makes a meaningful contribution to preserving this intangible cultural heritage, which remains at risk of erosion under the influence of modernization. By documenting traditional herbal practices in a systematic and structured manner, this work provides not only a valuable repository for safeguarding local knowledge but also a robust foundation for future investigations in pharmacology, phytochemistry, and biochemistry.

Ensuring the safe and effective use of medicinal plants requires fostering synergy between traditional knowledge and modern science. This calls for an integrative evidence-based, and ecologically responsible approach to phytotherapy, through sustained collaboration among herbalists, researchers, policymakers, and local communities.

Conclusion

Phytotherapy remains a widespread and deeply rooted practice in Morocco, as demonstrated by the documentation of six medicinal plants traditionally employed against infectious and other ailments. This ethnobotanical survey systematically recorded and analyzed the traditional knowledge held by herbalists, thereby contributing to the scientific valorization of Morocco's medicinal heritage.

Our findings confirm that these six species—through their recognized antibacterial potential and traditional therapeutic uses—represent promising candidates for further pharmacological validation. The study thus provides a concrete framework for linking ethnobotanical data with modern pharmacological research, in order to identify effective natural alternatives against *Staphylococcus* infections.

Ultimately, integrating traditional knowledge with experimental pharmacology will help ensure the safe, evidence-based, and sustainable use of medicinal plants, while preserving Morocco's rich cultural heritage in herbal medicine.

Declarations

Ethics approval and consent to participate: This ethnobotanical survey was approved by the Internal Ethics Committee of the Biological Geology Department of the Polydisciplinary Faculty of Sultan Moulay Slimane University, Beni Mellal, and by the Ethics Committee for Biomedical Research of the Faculty of Medicine and Pharmacy of Mohammed I University, Oujda, Morocco (Approval No. 15/2023). All participants provided prior informed consent before being interviewed.

Consent for publication: Not applicable

Availability of data and materials: The full questionnaire used in this study is provided as Appendix S1 (Arabic and English), and the datasets analyzed are available from the corresponding author on reasonable request.

Competing interests: Not applicable

Funding: Not applicable

Author contributions: Aniba Rafik., Conceptualization, methodology, software, formal analysis, investigation, resources, data curation, writing original draft. Asmaa Dihmane., Methodology, investigation, formal analysis. Habiba Raqraq., Software, investigation. Amina Ressmi., Methodology, investigation, conceptualization, investigation. Kaotar Nayme., Visualization, validation, supervision. Timinouni Mohammed., Writing review & editing, validation, supervision. Barguigua Abouddihaj., Writing, review & editing, visualization, validation, supervision, resources, project administration, conceptualization.

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Appendix S1. Questionnaire (original Arabic and certified English translation)

Instrument used in the survey of herbalists in the Casablanca–Settat region, Morocco

أداة البحث الميداني الموجهة للعشابين في جهة الدار البيضاء ـ سطات، المغرب

Purpose	الغرض من الاستبيان
This questionnaire was designed to document ethnomedicinal knowledge among herbalists in the Casablanca–Settat region of Morocco concerning six medicinal plants — <i>Lavandula angustifolia</i> Mill., <i>Salvia sclarea</i> L., <i>Mentha pulegium</i> L., <i>Pinus halepensis</i> Mill., <i>Pistacia lentiscus</i> L., and <i>Origanum compactum</i> Benth. It includes socio-demographic data, knowledge sources, uses, preparation methods, and perceptions on conservation and integration into modern healthcare. A pilot test with 40 herbalists confirmed the clarity of all items (Cronbach's $\alpha = 0.70$).	يهدف هذا الاستبيان إلى جمع المعارف العشابية التقليدية لدى العشابين في جهة الدار البيضاء ـ سطات حول ست نباتات طبية هي: الخزامى (<i>Lavandula angustifolia</i>) ، المريمية (<i>Salvia sclarea</i>) ، النعناع البري (<i>Mentha pulegium</i>) ، الصنوبر (<i>Pinus halepensis</i>) ، العدس (<i>Pistacia lentiscus</i>) ، والأوريغانو (<i>Origanum compactum</i>). يتضمن بيانات اجتماعية وديموغرافية، ومصادر المعرفة، واستخدامات النباتات، وطرق التحضير، والتصورات حول حفظ هذه المعارف وإدماجها في النظام الصحي الحديث. أُجري اختبار أولي على 40 عشابًا لتقييم وضوح الأسئلة، وكانت نتائج الثبات مقبولة ($\alpha = 0.70$).
Section I – General Information	المعلومات العامة
1. Age	1. العمر
2. Gender ☐ Male ☐ Female	2. الجنس ☐ ذكر ☐ أنثى
3. Residence ☐ Urban ☐ Rural	3. مكان الإقامة ☐ حضري ☐ قروي
4. Education ☐ Illiterate ☐ Primary ☐ Secondary ☐ Higher	4. المستوى التعليمي ☐ أمي ☐ ابتدائي ☐ ثانوي ☐ جامعي
5. Socio-economic status ☐ Low ☐ Medium ☐ High	5. الوضع الاجتماعي-الاقتصادي ☐ ضعيف ☐ متوسط ☐ مرتفع
6. Region (specify) :	6. المنطقة (اذكر):
Section II – Knowledge Sources	مصادر المعرفة
7. Years of herbal practice ☐ < 5 ☐ 5–10 ☐ > 10	7. مدة مزاوله العشابة ☐ أقل من 5 سنوات ☐ من 5 إلى 10 ☐ أكثر من 10 سنوات
8. Main sources of knowledge (select all that apply) ☐ Family or intergenerational transmission ☐ Learning in local markets (souks) ☐ Training with other herbalists ☐ Cultural or ritual practices ☐ Personal experience or experimentation	8. ما هي المصادر الرئيسية لمعارفك حول النباتات الطبية؟ (اختر كل ما ينطبق) ☐ الوراثة العائلية أو النقل الجيلي ☐ التعلم في الأسواق المحلية (السوق / السوق الأسبوعي) ☐ التدريب مع عشابين آخرين ☐ الممارسات الثقافية أو الطقوسية ☐ الخبرة أو التجربة الشخصية
Section III – Identification and Use of Plants	تحديد واستعمال النباتات الطبية
9. Do you use medicinal plants to treat infections? ☐ Yes ☐ No	9. هل تستعمل النباتات الطبية لعلاج الالتهابات؟ ☐ نعم ☐ لا
10. Which plants do you use?	10. ما هي النباتات التي تستعملها؟
	الخزامى → Lavender (<i>Lavandula angustifolia</i>) المريمية → Clary sage (<i>Salvia sclarea</i>) النعناع البري → Pennyroyal mint (<i>Mentha pulegium</i>) الصنوبر → Aleppo pine (<i>Pinus halepensis</i>) العدس → Mastic tree (<i>Pistacia lentiscus</i>) الأوريغانو → Compact oregano (<i>Origanum compactum</i>)
11. Health problems treated	11. الأمراض أو المشاكل الصحية التي تعالج بها هذه النباتات

- ☐ Catheter / prosthesis infections
☐ Wound or surgical infections
☐ Genito-urinary infections
☐ Arthritis / osteomyelitis
☐ Skin infections (furuncles, cellulitis)
☐ Respiratory infections
12. Who diagnoses the condition?
☐ Self ☐ Herbalist ☐ Doctor ☐ Other
13. Form used
☐ Fresh ☐ Dried ☐ Processed
14. Plant parts used
 Leaves- Flowers- Fruits- Stem- Bark
 Roots -Whole plant / Entire plant
15. Preparation parameters :
 Duration :
 Temperature :
 Solvent :
16. Preparation methods
☐ Infusion ☐ Decoction ☐ Powder ☐ Tincture ☐ Distillation ☐ Other
17. Mode of use
☐ Single plant ☐ Mixture ☐ With drugs
18. Dosage form
☐ Pinch ☐ Spoon ☐ Handful ☐ Measured
19. Administration route
☐ Oral ☐ Massage ☐ Rinse ☐ Topical ☐ Other
20. Frequency
☐ Once / day ☐ Twice / day ☐ ≥ 3 times / day
21. Duration
☐ One day ☐ One week ☐ One month ☐ Until recovery
22. Observed results
☐ Effective ☐ Ineffective (specify)
23. Side effects
☐ Yes (specify) ☐ No
12. من يشخص المرض؟
☐ نفسك ☐ عشاب ☐ طبيب ☐ آخر
13. شكل النبات المستعمل
☐ طازج ☐ مجفف ☐ مُحضّر
14. الأجزاء المستعملة من النبات
 الأوراق – الأزهار – الثمار – الساق – اللحاء – الجذور – النبات كاملاً
15. معايير التحضير
 المدة:
 درجة الحرارة:
 المذيب:
16. طرق التحضير
☐ نقع ☐ غلي ☐ مسحوق ☐ صبغة ☐ تقطير ☐ أخرى
17. طريقة الاستعمال
☐ نبات واحد ☐ خليط ☐ مع أدوية
18. الكمية
☐ قرصة ☐ ملعقة ☐ حفنة ☐ كمية محددة
19. طريقة الإعطاء
☐ عن طريق الفم ☐ تدليك ☐ مضمضة ☐ دهان ☐ أخرى
20. عدد المرات
☐ مرة في اليوم ☐ مرتين ☐ ثلاث مرات أو أكثر
21. مدة العلاج
☐ يوم ☐ أسبوع ☐ شهر ☐ حتى الشفاء
22. النتائج بعد الاستعمال
☐ فعالة ☐ غير فعالة (حدد)
23. آثار جانبية
☐ نعم (وضح) ☐ لا

Section IV – Accessibility and Conservation

توفر النباتات وحفظها

24. Are the plants easily available?
☐ Yes ☐ No
25. Specific collection periods
☐ Yes ☐ No
26. Main sources
☐ Wild ☐ Cultivated ☐ Market
27. Conservation efforts
☐ Yes ☐ No
28. Impact of climate change
☐ Yes ☐ No
24. هل النباتات متوفرة بسهولة في المنطقة؟
☐ نعم ☐ لا
25. هل هناك فترات معينة لجمع النباتات؟
☐ نعم ☐ لا
26. مصدر الحصول
☐ برية ☐ مزروعة ☐ سوق تجارية
27. جهود لحماية النباتات
☐ نعم ☐ لا
28. تأثير التغير المناخي على توفرها
☐ نعم ☐ لا

Section V – Transmission and Perception

نقل المعارف والتصورات

29. Do you transmit your knowledge to others?
☐ Yes ☐ No
30. Main advantages
29. هل تنقل معارفك حول النباتات إلى آخرين؟
☐ نعم ☐ لا
30. أهم مزايا استخدام النباتات

☐ Effective ☐ Affordable ☐ Alternative

☐ فعالة ☐ رخيصة ☐ بديل للأدوية

31. Overall satisfaction

31. درجة الرضا

☐ Dissatisfied ☐ Satisfied ☐ Highly satisfied

☐ غير راضي ☐ راضي ☐ راضي جداً

32. Should medicinal plants be integrated into modern medicine?

32. هل يجب إدماج النباتات الطبية في النظام الصحي الحديث؟

☐ Yes ☐ No

☐ نعم ☐ لا

33. Main challenges

33. أهم التحديات

☐ Biodiversity loss ☐ Decline of knowledge ☐ Modernization ☐ تغير ☐ تحديث الرعاية ☐ نقص نقل المعارف ☐ فقدان التنوع البيولوجي ☐ المناخ

Climate change